USAPHC
U.S. ARMY PUBLIC HEALTH COMMAND
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EPIDEMIOLOGICAL REPORT NO. 12-HF-97G010-09

INFLUENCE OF A VISCOELASTIC INSOLE ON FOOT, KNEE AND BACK PAIN AMONG MEMBERS OF THE UNITED STATES ARMY BAND AUGUST 2009-MARCH 2010

Injury Study 40-38a

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
13 July 2010	Technical Report	August 2009- March 2010

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Influence of a Viscoelastic Insole on Foot, Knee and Back Pain among Members of the United States Army Band	5b. GRANT NUMBER Health Promotion and Prevention Initiatives Program, 2009 (No grant number provided, just memorandum from MCHB-CG)
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) Tyson Grier, Joseph J Knapik, David Swedler, Bruce H Jones	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
US Army Public Health Command, Aberdeen Proving Ground MD	12-HF-97G010-09

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT: Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT: Standing and marching have been associated with musculoskeletal pain of the feet as well as discomfort and fatigue of the back and lower extremities. U.S. Army Band members spend hundreds of hours a year standing and marching. To see if musculoskeletal pain could be reduced, one pair of viscoelastic silicone insoles were provided to band members (n=69). These insoles incorporated a metatarsal pad, ventilation holes for circulation, and a slight contour in the arch support area. Before the insoles 48% and 45% of band members reported foot and back pain, respectively. After using the insoles, for at least 50% of the time or greater, 28% and 26% (p=0.02 and 0.04) of band members reported foot and back pain, respectively. After adjusting for correlated outcome data and initial differences, band members were 74% and 59% less likely to have foot and back pain, respectively, after wearing the insoles for 8-12 weeks. It is recommended that band members use insoles to reduce musculoskeletal pain.

15. SUBJECT TERMS:

16. SECURITY CLASSIFICATION OF: UNCLASSIFIED			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified			410-436-5450

Tyson Grier

Standard Form 298 (Rev.8/98)
Prescribed by ANSI Std. Z39.18

DEPARTMENT OF THE ARMY
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EXECUTIVE SUMMARY
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AUGUST 2009-MARCH 2010

1. INTRODUCTION AND PURPOSE. Minimizing fatigue and musculoskeletal pain is important for U.S. Army Band members who are involved in hundreds of performances each year. These performances often include prolonged standing and marching. In a previous epidemiological investigation, over 50 percent of the band members (122 of 230) noted problems with their shoes. Of the focus groups that were interviewed as part of this project, 5 out of 11 groups suggested that their current footwear was a risk factor for injury, pain and discomfort. Some of the problems band members noted with their footwear were a lack of cushioning, lack of support, felt too hot, and did not appear to be designed for marching and standing. Subsequently, efforts were made to improve band footwear by providing members shoes that had favorable properties such as outsoles with built in compression pads and better overall breathability. After wearing the shoes for one year, band members were asked to rate the characteristics of the shoes. One of the characteristics found to independently increase the risk of foot pain/discomfort was a poor cushioning rating of the shoe. Therefore, in the current investigation, insoles were provided to the band members in an effort to increase cushioning and decrease musculoskeletal pain/discomfort. The purpose of this project was to examine the influence of a viscoelastic insole on foot, knee and back pain/discomfort among members of the U.S. Army Band.

2. METHODS.

a. Project Design. One pair of insoles were provided to selected band members. These band members were asked to complete a questionnaire before the insoles were provided (initial questionnaire) and 8 to 12 weeks after the insoles were issued (follow-up questionnaire).

b. Participants and Insoles. Participants were Service members in the U.S. Army Band (“Pershing’s Own”) garrisoned at Fort Myer, Virginia. One pair of insoles were provided to each band member in the Ceremonial, Chorus, and Concert groups. The insoles were composed of medical grade viscoelastic silicone, incorporating a metatarsal pad, ventilation holes for circulation and a slight contour in the arch support area. According to the manufacturer, these insoles can be used for shock absorption, foot, joint and back pain, diabetic foot, metatarsalgia, hyperkeratosis, and fat pad

atrophy. It was recommended that the band members removed their current insole when using the viscoelastic insole.

c. Questionnaires. The initial questionnaire asked participants about their physical characteristics, performance group (Ceremonial, Chorus, and Concert), practice, rehearsal and performance durations, shoes, their current insoles, orthotics, instrument weight, foot pain, knee pain, back pain, and aerobic and strength training. The follow-up questionnaire asked participants about band activities, shoes, foot pain, knee pain, back pain, aerobic and strength training, and the characteristics of the viscoelastic insoles.

d. Physical Characteristics and Army Physical Fitness Test Scores. Height, weight, age and scores from each band member's most recent Army Physical Fitness Test (APFT) were obtained directly from the Personnel Office (S-1) of U.S. Army Band. The APFT consisted of three events: a 2-minute maximal effort push-up event, a 2-minute maximal effort sit-up event, and a 2-mile run performed for time. Body mass index (BMI) was calculated as weight/height^2.

e. Data Analysis. The Statistical Package for the Social Sciences (SPSS®), Version 16.0, was used for statistical analysis. Chi-Square statistics were used to examine differences in pain and discomfort of the foot, knee and back for those who wore the insoles for < 50 percent and ≥ 50 percent of the time. A McNemar test was used to compare foot, knee and back pain before and after wearing the insoles for band members wearing the insoles < 50 percent of the time and for band members wearing the insoles ≥ 50 percent of the time. Potential risk factors (e.g. age, BMI, marching and standing time) for initial foot and back pain were explored using Chi-Square statistics. Risk factors with p≤ 0.10 in the chi-square analysis were selected to be used in a General Estimating Equations model. General Estimating Equations were used to examine initial and follow-up foot and back pain. There were two other variables also selected for the model in addition to the risk factors from the Chi-Square analysis. The first variable was the time the insoles were worn, to be used as a covariate controlling for the amount of time band members wore the insoles (8-12 weeks). The second variable was initial and follow-up survey, used to examine foot and/or back pain before and after the insoles were worn. (SPSS® is a registered trademark of International Business Machines Corporation "IBM.")

3. RESULTS.

a. There were 152 band members who received the viscoelastic insoles and completed the initial survey. However, only 69 band members completed both the initial

and final survey. Some of the reasons for the low number of completion rates involved band members who did not return for the follow-up survey (the majority), received the insoles but never wore them, preferred other insoles, reported that the insoles were too tight, or wore orthotics. Therefore the final group consisted of 69 band members with 29 band members reporting wearing the insoles < 50 percent of the time and 40 of the band members reporting wearing the insoles ≥ 50 percent of the time.

b. There were no differences in foot, knee or back pain between those who reported wearing the insoles ≥ 50 percent of the time compared to those who wore the insoles <50 percent of the time after 8-12 weeks.

c. There was also no differences found for band members wearing the insoles < 50 percent of the time for foot, knee and back pain before and after 8-12 weeks. However when examining just the group of band members who wore the insoles for ≥ 50 percent of the time, 20 percent and 19 percent fewer band members reported foot ($p=0.02$) and back pain ($p=0.04$) at the follow up survey, respectively. No differences were found for knee pain ($p=0.11$) at the follow up survey in the band members who wore the insoles ≥ 50 percent of the time. Adjusting for correlated outcome data and initial differences, band members who wore the insoles ≥ 50 percent of the time were 74 percent and 59 percent less likely to have foot and back pain, respectively, after 8-12 weeks. Older age and moderate marching time were also found to place band members at a higher risk of foot pain.

4. DISCUSSION.

a. The major finding of this project was that after wearing the viscoelastic insoles for 8-12 weeks, band members were 74 percent and 59 percent less likely to experience foot and back pain causing them to limit their daily activities, respectively.

b. The decreased risk of foot pain could have been attributed to increased comfort and cushioning of the insoles. Foot comfort is subjective, but can be related to plantar pressure and support. Therefore the insoles may have reduced foot pain and increased foot comfort because they distribute plantar pressures (contour insoles do this more effectively), reduce peak pressures on impact and absorb a greater percentage of shock. It has also been suggested that long term wear of insoles by healthy subjects will decrease the loading of the musculoskeletal system (through increased shock absorption) and may decrease the progressive weakening of the natural shock absorbers (i.e., ankles, knees).

c. It has also been suggested that the increased shock attenuation and dissipation of shock waves through insoles may contribute to the reduction in back pain. In a previous investigation, researchers found 79 percent of subjects who wore the insoles

for one year reported excellent or good improvements in back pain compared to a control group where only 45 percent reported excellent or good improvements in back pain. The researchers suggest that poor walking impact attenuation was a cause of prolonged strain on the intervertebral structure and that viscoelastic insoles may reduce back pain through increased impact attenuation.

5. RECOMMENDATIONS. The viscoelastic insoles were effective in reducing musculoskeletal pain and discomfort of the foot and back among band members wearing them for ≥ 50 percent of the time. It is recommended that the band members use insoles to increase comfort and decrease musculoskeletal pain.

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AUGUST 2009 – MARCH 2010

1. REFERENCES. Appendix A contains a list of scientific/technical references used in this report.

2. AUTHORITY. Under Army Regulation (AR) 40-5[1] (paragraph 2-19), the U.S. Army Public Health Command is responsible for supporting Army preventive medicine activities, to include interpretation of surveillance data, identification of leading health problems, and assistance in prevention and control of leading health problems. In January 2006, the U.S. Army Medical Command received a letter from COL Thomas Rotondi, Leader and Commander of the U.S. Army Band requesting that MEDCOM examine injury rates and provide injury prevention recommendations. In the first report on this consultation[2] it was stated that viscoelastic insoles could be of benefit to band members in the reduction of pain, discomfort and fatigue related to prolonged standing. Therefore, these insoles were provided to band members in an attempt to reduce their musculoskeletal pain and improve their comfort. This project was funded in Fiscal Year 2009 by the Health Promotion and Prevention Initiatives (HPPI) Program. The HPPI initiatives in the U.S. Army Medical Department are funded by the Office of the Assistant Secretary of Defense for Health Affairs.

3. INTRODUCTION AND PURPOSE

a. Minimizing fatigue and musculoskeletal pain is important for U.S. Army Band members who are involved in hundreds of performances each year. These presentations often include prolonged standing, marching and can be conducted in unfavorable weather conditions; they can result in fatigue and may cause musculoskeletal pain because of their frequency and duration. In a previous epidemiological investigation examining the U.S. Army Band, over 50 percent of the band members noted problems with their shoes. Of the focus groups that were interviewed as part of this project, 5 out of 11 groups suggested that their current footwear was a risk factor for injury, pain and discomfort. Some of the problems noted with their current footwear, were a lack of cushioning and support, and the facts that the shoes were too hot and didn't appear to be designed for marching and standing.[2] Therefore efforts were made to improve the footwear of the band members by providing them shoes with some favorable properties such as outsoles with built in compression pads in the heel and forefoot as well as better breathability. After wearing the shoes for one year band members were asked to rate various characteristics of the shoes. About a third of the band members rated the comfort of the shoe as "poor" (flexibility, support, cushioning) and about a quarter rated the fit characteristics (width, toe room, overall fit)

of the shoes as "poor". One of the characteristics found to independently increase the risk of foot pain/discomfort was a poor cushioning rating of the shoe.[3]

b. Since the selected shoes were not acceptable and did not seem to reduce foot discomfort, another strategy was employed. Insoles were provided to band members in an effort to increase cushioning and decrease musculoskeletal pain/discomfort. This paper described the results of this project, the purpose of which was to examine the influence of a viscoelatic insole on foot, knee and back pain and discomfort among members of the U.S. Army Band.

4. BACKGROUND LITERATURE

a. Musculoskeletal discomfort associated with prolonged standing/marching. Musculoskeletal discomfort and pain of the lower extremities and back has been associated with prolonged standing,[4, 5, 6, 7, 8] as well as standing/walking.[9] In a study of supermarket workers, investigators found a positive correlation between the proportion of time spent standing and symptoms in the lower limb ($R^2 = 0.87$, $p<0.01$) and ankle and foot ($R^2 = 0.95$, $p<0.01$).[7] In another study investigating prolonged standing and walking work on different floor surfaces, investigators found that two hours of standing/walking increased low back discomfort (as rated by a visual analog scale 0 percent no discomfort, 100 percent worst conceivable discomfort) from 5 percent to 27 percent ($p< 0.01$) and foot pain from 8 percent to 27 percent ($p <0.01$).[9] In the previous study of the U.S. Army Band, band members who spent over 2 hours standing or marching had approximately a 3 times higher risk of back pain and 6 times higher risk of foot pain when standing or marching for 2 hours compared to 1 hour, respectively.[3]

b. Insoles, musculoskeletal pain and fatigue. Multiple studies have demonstrated that insoles are effective in decreasing musculoskeletal pain and fatigue.[4, 10, 11, 12, 13, 14] In a study investigating viscoelastic insoles and occupations that require standing at least 75 percent of the time, researchers found that wearing insoles decreased foot, back, and leg pain relative to just wearing shoes.[4] In a study investigating flooring and standing, investigators found that inserts had the lowest leg tiredness ratings when compared to seven other flooring conditions ranging from soft materials to concrete.[14] The decrease in musculoskeletal pain and fatigue attributed to the insoles could be a result of increased shock attenuation,[15, 16, 17] reduced peak pressures generated on the musculoskeletal system,[18, 19] and/or a reduction in plantar pressures.[20, 21, 22, 23]

c. Insole materials. Commercial-off-the-shelf as well as custom insoles are available in various combinations of materials. The insole materials can consist of polyurethane, ethylene vinyl acetate, polyethylene, latex, poron, plastazote, and silicone as well as other material. There have been multiple studies evaluating the effects of the different types of insole materials.[18, 24, 19, 23, 25, 26] In a study investigating four different

types of insoles made from various materials, investigators found that the insole made from polyurethane in combination with viscoelastic material were the most effective in reducing musculoskeletal impact of the foot when compared to the others.[18] In another study investigating seven different types of insoles, investigators found that an open cell firm foam material was most effective in decreasing plantar pressure.[23] Although both of these studies identified specific types of materials that were the most effective in reducing impact or shock attenuation, all insoles in both studies were found to be effective (some more than others) when compared to the no insole condition. However, the perceived comfort of the various types of insole materials may vary from one individual to another. What one individual may find comfortable another may find uncomfortable. Differences in individuals such as arch height, leg alignment, foot sensitivity, and plantar pressure may be the reason why some types of insert materials are comfortable to some but not others. Therefore, comfort may be dependent on both individual characteristics and the on the insole material examined.

5. METHODS

a. Project design. Band members in the Ceremonial, Chorus, and Concert performance groups were provided one pair of insoles. Those who received the insoles were asked to complete a questionnaire when the insoles were offered (initial questionnaire). Approximately 8 to 12 weeks after the insoles were issued a second questionnaire was administered (follow-up questionnaire).

b. Participants. Participants were Soldiers in the U.S. Army Band's ("Pershing's Own"), Ceremonial, Chorus, and Concert performance groups who were garrisoned at Fort Myer, Virginia. The Ceremonial band performs hundreds of military funerals each year, as well as monthly retirement parades, arrival and departure honors for foreign dignitaries, and wreath laying ceremonies. Their duties require more time on their feet than any of the other groups. The Chorus covers a broad spectrum of music to include pop, Broadway folk, and classical. The group often performs at the White House and in support functions hosted by the State Department and Department of Defense. The Concert group performs at national and international music events.

c. Insoles. The insoles provided to the band members were composed of medical grade viscoelastic silicone, incorporating a metatarsal pad, ventilation holes for circulation and a slight contour in the arch support area. According to the manufacturer, these insoles can be used for shock absorption, foot, joint and back pain, diabetic foot, metatarsalgia, hyperkeratosis and fat pad atrophy. It was recommended that the band members removed their current insoles when placing the viscoelastic insoles in their shoes.

d. Questionnaires. The initial questionnaire asked participants about their physical

characteristics, performance group (Ceremonial, Chorus or Concert), practice, rehearsal and performance duration during the past 6 months and past 3 weeks, shoes, their current insoles, orthotic use, instrument weight, current foot, knee and back pain, and aerobic and strength training for the past 6 months and past 3 weeks. The follow-up questionnaire asked participants about specific band activities, shoes, foot pain, knee pain, back pain, aerobic and strength training, and the viscoelastic insoles (See Appendices B and C). Each questionnaire took about 15 minutes to complete.

e. Army Physical Fitness Test Scores. Scores from each band member's most recent Army Physical Fitness Test (APFT) were obtained directly from the Personnel Office (S-1) of U.S. Army Band. The APFT consisted of three events: a 2-minute maximal effort push-up event, a 2-minute maximal effort sit-up event, and a 2-mile run performed for time. In the push-up event, the subject lowered his/her body in a generally straight line to a point where his/her upper arm was parallel to the ground and then returned to the starting point with elbows fully extended. In the sit-up event, the subject's knees were bent at a 90 degree angle, fingers were interlocked behind the head, and a second person held the subject's ankles, keeping his or her heels firmly on the ground. The subject raised his/her upper body to a vertical position so that the base of the neck was anterior to the base of the spine and then returned to the starting position. Scores were the number of push-ups and sit-ups successfully completed within the separate 2-minute time periods. The performance measure for the run was the time taken to complete the 2-mile distance. Time between events was no less than 10 minutes.

f. Data analysis.

(1) The Statistical Package for the Social Sciences (SPSS®), Version 16.0, was used for statistical analysis Descriptive statistics (frequencies, distributions and/or means ± SD) were calculated for age, Body mass index (BMI), instrument weight, functional group, performance group, time insoles were worn, shoe comfort, if band members wore insoles or orthotics previous to the study, APFT scores, physical activity, and practice, standing, and marching time. The BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Soldiers were classified into "functional groups" depending on the instruments they used. These included brass, woodwinds, percussion, strings and vocal. (SPSS® is a registered trademark of International Business Machines Corporation "IBM".)

(2) A paired T-test was used to determine if there were any differences in the amount of time spent per week performing physical activity before and after wearing the insoles.

(3) An analysis of variance (ANOVA) was used to determine if there were any differences in reported practice, standing, and marching time from 6 months before the insoles to the follow-up survey.

(4) Chi-Square statistics were used to examine differences in pain and discomfort of the foot, knee, and back for those who reported wearing the insoles for ≥ 50 percent and < 50 percent of the time.

(5) A McNemar test was used to compare foot, knee, and back pain before and after wearing the insoles for various periods of time.

(6) Potential risk factors for initial foot and back pain were explored using Chi-Square statistics. Risk factors with $p \leq 0.10$ were selected to be used in a general estimating equations model.

(7) General estimating equations were used to examine initial and follow-up foot and back pain. There were two other variables also selected for the model in addition to the risk factors from the Chi-Square analysis. The first variable was (time the insoles were worn) used as a covariate controlling for the amount of time band members wore the insoles (8-12 weeks). The second variable was (initial and follow-up survey) used to examine foot and/or back pain before and after the insoles were worn.

6. RESULTS. There were 152 band members who received the viscoelastic insoles and completed the initial survey. However, only 69 band members completed the initial and final survey. Some of the reasons for the low number of completion rates involved band members who: 1) did not return for the follow-up survey (the large majority), 2) received the insoles but never wore them, 3) already had insoles they preferred, 4) reported that the insoles were too tight, or 5) wore orthotics and chose not to try the insoles. Therefore the final group consisted of 69 band members with 29 band members reporting wearing the insoles < 50 percent of the time and 40 of the band members reporting wearing the insoles ≥ 50 percent of the time.

a. Descriptive statistics.

(1) Table 1 shows descriptive statics from the initial and final survey. As might be expected, there were no changes in Soldier's reporting of their functional and performance groups during the 8-12 weeks the band members wore the insoles.

Table 1. Descriptive Statistics from Initial and Final Survey Questionnaire

Variable	Level of Variable	Initial Survey		Final Survey	
		n	%	n	%
Gender	Men	60	87	60	87
	Women	9	13	9	13
Functional Group	Brass	29	42	29	42
	Woodwind	13	19	13	19
	Percussion	6	9	6	9
	Strings	7	10	7	10
	Vocal	14	20	14	20
Performance Group	Ceremonial	20	29	20	29
	Chorus	19	28	19	28
	Concert	30	44	30	44
Shoe Comfort: Are the shoes worn during band activities comfortable	Not comfortable	10	15	9	13
	Somewhat comfortable	29	43	28	41
	Comfortable	17	25	25	37
	Very comfortable	11	16	6	9
	Extremely comfortable	1	2	0	0
	Missing	1		1	
Instrument Weight	.5-4 lbs	16	33	-	-
	5-7 lbs	11	22	-	-
	8-11 lbs	14	29	-	-
	12+ lbs	8	16	-	-
	Missing	20		-	-
Insoles: Do you currently wear insoles	No	47	71	-	-
	Yes	19	29	-	-
	Missing	3		-	-
Orthotics: Do you currently wear orthotics	No	51	80	-	-
	Yes	13	20	-	-
	Missing	5		-	-
Percentage of time insoles were worn for performances at the follow up survey	0%	-	-	20	30
	10-20%	-	-	9	14
	30-40%	-	-	0	0
	50-60%	-	-	6	9
	70-80%	-	-	1	2
	90-100%	-	-	30	46
	Missing	-	-	3	
Percentage of time insoles were worn for rehearsals at the follow up survey	0%	-	-	32	49
	10-20%	-	-	8	12
	30-40%	-	-	1	2
	50-60%	-	-	3	5
	70-80%	-	-	1	2
	90-100%	-	-	20	31
	Missing	-	-	4	
Percentage of time insoles were worn for practices at the follow up survey	0%	-		33	48
	10-20%	-	-	11	16
	30-40%	-	-	2	3
	50-60%	-	-	3	4
	70-80%	-	-	1	1
	90-100%	-	-	19	28

(2) Table 2 shows age, BMI and APFT scores. The APFT test was performed during the 8-12 weeks the band members were wearing the insoles.

Table 2. Army Physical Fitness Test

Variable	Level of Variable	n	%	Mean± SD
Age	25–35 years 36-44 years 45-56 years	24 17 28	35 25 41	41±9
Body Mass Index	20-25 kg/m^2 26-29 kg/m^2 30-36 kg/m^2	22 35 12	32 51 17	26.7±3.0
2-Mile Run	12.88-15.65 min 15.66-17.45 min 17.46-19.64 min Missing	16 16 16 21	33 33 33	16.0±1.7
Push-Ups	0-32 reps 33-47 reps 48-86 reps	20 25 24	29 36 35	43±20
Sit-Ups	0-39 reps 40-51 reps 52-83 reps	21 25 23	30 36 33	47±18

(3) Table 3 shows aerobic exercise and strength training before and after wearing the viscoelastic insoles. There were no differences in the amount of time spent performing aerobic exercise and strength training before and after wearing the viscoelastic insoles.

Table 3. Physical Activity Before and After Wearing the Viscoelastic Insoles

Survey	Activity	Weekly Frequency	n	%	Mean± SD	Paired T-Test
Initial	Aerobic Exercise Frequency	≤ 1 time /wk 2–4 times/wk 5–7 times/wk Missing	2 48 18 1	3 71 27	3.5±1.4	0.16
Follow-Up	Aerobic Exercise Frequency	≤ 1 time /wk 2–4 times/wk 5–7 times/wk Missing	4 51 14	6 73 20	3.4±1.4	
Initial	Strength Training Frequency	≤ 1 time /wk 2–4 times/wk 5–7 times/wk Missing	19 44 5 1	28 65 7	2.4±1.5	0.17
Follow-Up	Strength Training Frequency	≤ 1 time /wk 2–4 times/wk 5–7 times/wk Missing	15 49 5	22 71 7	2.6±1.5	

(4) Table 4 shows practice, rehearsal, performance, standing and marching time per day before receiving the viscoelastic insoles, and at the follow up survey. Average practice, rehearsal, and performance time was a little over 3 hours per day. Average amount of time standing and marching was about 2 hours per day. There were no differences in practice, rehearsal, and performance or standing and marching time over the 3 time periods.

Table 4. Time Spent Rehearsing, Practicing, Performing, Standing and Marching per day During the Past 6 Months, Past 3 Weeks Before Receiving the Viscoelastic Insoles and at the Follow-Up Survey

Time Spent	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**(ANOVA) p-value**
	Last 6 months prior to receiving insoles	Last 3 weeks prior to receiving insoles	Follow-Up Survey last 8-12 weeks after receiving insoles	Between Periods
Practice, Rehearsal and Performance Time (minutes)	189±64 min	184±62 min	189±79 min	0.89
Standing (minutes)	119±53min	115±50 min	117±52 min	0.91
Marching (minutes)	113±47 min	117±48 min	120±52 min	0.74

b. Foot, knee and back pain for band member who wore the insoles < 50 percent of the time compared to band members who wore the insoles ≥ 50 percent of the time.

(1) Table 5 shows the proportion of band members who reported foot, knee and back pain from the final survey, comparing band members who wore the insoles ≥ 50 percent of the time to band members who wore the insoles <50 percent of the time. There were no differences in foot, knee, and back pain between the two groups.

Table 5. Proportion of Band Members who Reported Foot, Knee, and Back Pain Comparing Those Who Wore the Insoles ≥ 50 percent to Those Who Wore the Insoles < 50 percent of the Time (Final Survey)

Location	**Wore Insoles ≥ 50% (n=40)**	**Wore Insoles < 50% (n=29)**	**Difference**	**Chi-Square p-value**
Foot Pain	28%	24%	4%	0.75
Knee Pain	15%	31%	16%	0.11
Back Pain	25%	24%	1%	0.94

(2) Because some of the soldiers wore the insoles < 50 percent and others wore the insoles ≥ 50 percent of the time, additional analysis was performed to investigate

any before and after differences on the percent of time the insoles were worn and musculoskeletal pain. Table 6 shows foot, knee and back pain before and after wearing the insoles for those who wore the insoles < 50 percent of the time. No differences were found for foot, knee or back pain before and after wearing the insoles for < 50 percent of the time.

Table 6. McNemar Test for Foot, Knee and Back Pain Before and After Wearing the Insoles for Those Who Wore the Insoles < 50 Percent of the time

Type of Pain	n	Before	After	Difference	p-value
Foot Pain	29	34%	24%	10%	0.38
Knee Pain	29	28%	31%	3%	1.00
Back Pain	29	31%	24%	6%	0.63

(3) Table 7 shows foot, knee and back pain before and after wearing the insoles for those who wore the insoles ≥ 50 percent of the time. The number of band members reporting foot and back pain decreased, for those who wore the insoles ≥ 50 percent of the time. There was no change in knee pain.

Table 7. Foot, Knee, and Back Pain Before and After Wearing the Insoles for Those Who Wore the Insoles ≥ 50 Percent of the Time

Type of Pain	n	Before	After	Difference	p-value (McNemar Tests)
Foot Pain	40	48%	28%	20%	0.02
Knee Pain	38	21%	16%	5%	0.69
Back Pain	38	45%	26%	19%	0.04

c. Foot pain associated with band members who wore the insoles ≥ 50 percent of the time.

(1) Table 8 displays the results of Chi-square statistics, showing the association between self-reported foot pain and various measures obtained on the initial questionnaire for those who wore the insoles ≥ 50 percent of the time. Foot pain was associated with older age, higher BMI, less initial shoe comfort, wearing insoles prior to project and longer marching time.

Table 8. Association between Foot Pain and Various Factors on the Initial Questionnaire for Those Who Worn the Insoles ≥ 50 Percent of the Time

Variable	Variable Level	Initial Foot Pain		Chi-Square p-value
		No n (%)	Yes n (%)	
Gender	Men	18 (53)	16 (47)	0.89
	Women	3 (50)	3 (50)	
Age	25-34	10 (77)	3 (23)	0.04
	35-44	7 (54)	6 (46)	
	45-56	4 (29)	10 (71)	
BMI	20-25	12 (75)	4 (25)	0.07
	26-29	7 (39)	11 (61)	
	30-36	2 (33)	4 (67)	
Instrument Weight (pounds)	0 lbs	7 (58)	5 (42)	0.58
	.5-5 lbs	6 (46)	7 (54)	
	6-10 lbs	6 (67)	3 (33)	
	11+ lbs	2 (33)	4 (67)	
Functional Group	Brass	7 (44)	9 (56)	0.92
	Woodwind	4 (57)	3 (43)	
	Percussion	2 (67)	1 (33)	
	Strings	1(50)	1 (50)	
	Vocal	7 (58)	5 (42)	
Performance Group	Ceremonial	6 (46)	7 (54)	0.83
	Chorus	7 (58)	5 (42)	
	Concert	8 (53)	7 (47)	
Shoe Comfort	Not to somewhat comfortable	10 (40)	15 (60)	0.10
	Comfortable	6 (67)	3 (33)	
	Very to extremely comfortable	5 (83)	1 (17)	
Insoles worn prior to project	No	18 (60)	12 (40)	0.08
	Yes	2 (25)	6 (75)	
Orthotics worn prior to project	No	17 (55)	14 (45)	0.54
	Yes	2 (40)	3 (60)	
Rehearsal, Practice and Performance Time (minutes)	30-120 min	7 (54)	6 (46)	0.84
	121-180 min	8 (57)	6 (43)	
	181+ min	5 (53)	6 (55)	
Standing (minutes)	≤60 min	7 (50)	7 (50)	0.86
	61–120 min	6 (60)	4 (40)	
	121+ min	7 (50)	7 (50)	
Marching (minutes)	<30 min	12 (75)	4 (25)	0.07
	30-90 min	3 (30)	7 (70)	
	91+ min	5 (63)	3 (38)	
Aerobic Exercise in the last 3 weeks	≤ 1 time /wk	1 (50)	1 (50)	0.63
	2–4 times/wk	30(63)	18 (38)	
	5–7 times/wk	9 (50)	9 (50)	
Strength Training in the last 3 weeks	≤ 1 time /wk	11(58)	8 (42)	1.00
	2–4 times/wk	26 (59)	18 (41)	
	5–7 times/wk	3 (60)	2 (40)	

(2) Table 9 displays the number of weeks band members wore the insoles ≥ 50 percent of the time and the presence or lack of foot pain. For initial foot pain there were no differences between the groups. For follow-up foot pain there was approximately a

40 percent decrease in the number of band members reporting foot pain when comparing weeks 8 to 9-11 and 12. The percentage of band members reporting foot pain also decreased in the 8, 9-11 and 12 week groups when comparing initial foot pain to follow up foot pain.

Table 9. Number of Weeks Insoles Worn and Foot Pain from the Initial and Follow-up Survey Causing Band Members to Limit Daily Activities

Weeks	n	Foot Pain (Initial)	Chi Square p-value	n	Foot Pain (Follow-Up)	Chi Square p-value
8	13	62%	0.28	13	54%	0.04
9-11	7	57%		7	14%	
12	20	35%		20	15%	

(3) Table 10 shows the results of the general estimating equation for those who wore the insoles ≥ 50 percent of the time. Band members were 74 percent less likely to report foot pain after wearing the insoles for 8-12 weeks after adjusting for correlated outcome data and controlling for age, BMI, shoe comfort, insoles worn prior to the project, marching, and number of weeks the insoles were worn. Older age and moderate marching time also placed band members at a higher risk of foot pain. Results also indicated that foot pain decreased 11 percent for every additional week after the 8th week that the insoles were worn.

Table 10. General Estimating Equations Results for Initial and Follow-Up Foot Pain for those who wore the Insoles ≥ 50 Percent of the Time

Variable	Category	Odds Ratio (95% CI)	P-value
Initial and Follow-Up Survey (foot pain)	Initial Survey (foot pain before) Follow-Up Survey (foot pain after)	1.00 0.26 (0.08-0.87)	 0.03
Age	25-34 35-44 45-56	1.00 7.31 (0.79-67.49) 5.70 (0.80-40.44)	 0.08 0.08
BMI	20-25 26-29 30-36	1.00 3.88 (0.38-39.16) 2.97 (0.43-20.70)	 0.25 0.27
Shoe Comfort (Before and After)	Not to somewhat comfortable Comfortable Very to extremely comfortable	1.00 0.43 (0.02-8.71) 0.65 (0.07-5.85)	 0.58 0.70
Insoles worn prior to project	No Yes	1.00 1.21 (0.90-16.13)	 0.89
Marching (Before and After in Minutes)	<30 30-90 91+	1.00 6.79 (1.12-41.20) 0.95 (0.11-8.60)	 0.04 0.97
Number of Weeks Insoles were Worn		0.89 (0.83-0.96)	<0.01

d. Back pain associated with band members who wore the insoles ≥ 50% of the time.

(1) Table 11 displays the results of Chi-square statistics, showing the association between initial back pain and various factors on the initial questionnaire for band members who wore the insoles ≥ 50 percent of the time. No associations were found between initial back pain and band demographics.

Table 11. Association between Back Pain and Various Factors on the Initial Questionnaire for Those Who Worn the Insoles ≥ 50 percent of the Time

Variable	**Variable Level**	**Initial Back Pain**		**Chi-Square**
		No (%)	**Yes (%)**	**p-value**
Gender	Men	17 (53)	15 (47)	0.54
	Women	4 (67)	2 (33)	
Age	25-34	9 (69)	4 (31)	0.17
	35-44	8 (62)	5 (39)	
	45-56	4 (33)	8 (67)	
BMI	20-25	8 (53)	7 (47)	0.83
	26-29	9 (53)	8 (47)	
	30-36	4 (67)	2 (33)	
Instrument Weight	0	6 (50)	6 (50)	0.13
	.5-5	8 (73)	3 (27)	
	6-10	6 (67)	3 (33)	
	11+	1 (17)	5 (83)	
Functional Group	Brass	7 (47)	8 (53)	0.20
	Woodwind	6 (100)	0 (0)	
	Percussion	1 (33)	2 (67)	
	Strings	1 (50)	1 (50)	
	Vocal	6 (50)	6 (50)	
Performance Group	Ceremonial	8 (62)	5 (39)	0.84
	Chorus	6 (50)	6 (50)	
	Concert	7 (54)	6 (46)	
Shoe Comfort	Not to somewhat comfortable	13 (54)	11 (46)	0.23
	Comfortable	3 (38)	5 (63)	
	Very to extremely comfortable	5 (83)	1 (17)	
Insoles worn prior to project	No	17 (59)	12 (41)	0.66
	Yes	4 (50)	4 (50)	
Orthotics worn prior to project	No	18 (58)	13 (42)	0.11
	Yes	1 (20)	4 (80)	
Rehearsal, Practice and Performance Time (minutes)	30-120	7 (54)	6 (46)	0.86
	121-180	7 (54)	6 (46)	
	181+	7 (64)	4 (36)	
Standing (minutes)	≤60	8 (62)	5 (39)	0.86
	61–120	5 (50)	5 (50)	
	121+	8 (57)	6 (43)	
Marching (minutes)	<30	7 (44)	9 (56)	0.30
	30-90	7 (70)	3 (30)	
	91+	5 (71)	2 (29)	
Aerobic Exercise in the last 3 weeks	≤ 1 time /wk	0 (0)	1 (100)	0.52
	2–4 times/wk	15 (56)	12 (44)	
	5–7 times/wk	6 (60)	4 (40)	
Strength Training in the last 3 weeks	≤ 1 time /wk	4 (40)	6 (60)	0.50
	2–4 times/wk	16 (62)	10 (39)	
	5–7 times/wk	1 (50)	1 (50)	

(2) Table 12 displays the number of weeks band members wore the insoles ≥ 50 percent of the time and the presence or lack of back pain. Initially there was a difference in back pain among Soldiers who later wore the insoles for 8, 9-11 or 12 weeks. On the follow-up questionnaire, there were no differences in back pain among these Soldiers. The proportion of Soldiers experiencing back pain tended to be lower in all three groups after wearing the insoles.

Table 12. Number of Weeks Insoles Worn and Back Pain Limiting Activity from the Initial and Follow-up Survey

Weeks	n	Back Pain (Initial)	Chi Square p-value	n	Back Pain (Follow-Up)	Chi Square p-value
8	13	23%		13	15%	
9-11	6	83%	0.05	7	43%	0.40
12	19	47%		20	25%	

(3) Table 13 shows the presence of back pain for those who wore the insoles ≥ 50 percent of the time. Band members were 59 percent less likely to report back pain after wearing the insoles for 8-12 weeks. Other models using back pain, age, instrument weight, and orthotics worn prior to the project were also examined, but no conclusive results were found when examining these models.

Table 13. General Estimating Equations Results for Initial and Follow-Up Back Pain for those who wore the Insoles ≥ 50 percent of the Time

Variable	Category	Odds Ratio (95% CI)	P-value
Initial and Follow-Up Survey	Initial Survey (back pain)	1.00	
	Follow-Up Survey (back pain)	0.41 (0.21-0.79)	<0.01

7. DISCUSSION. The major finding of this project is that after wearing the viscoelastic insoles ≥ 50 percent of the time for 8-12 weeks, band members were respectively 74 percent and 59 percent less likely to experience foot and back pain causing them to limit their daily activities. Band members who wore the insoles for a longer period of time (e.g., 8 versus 12 weeks) were less likely to report foot pain. Even if the band members wore the insoles for ≥50 percent of the time, risk of foot pain increased with older age, higher BMI, less shoe comfort, wearing an insole prior to the start of the project, and marching for 30-90 minutes. Risk of back pain was not elevated by the factors examined in this study if the Soldiers wore the insoles for ≥ 50 percent of the time.

a. Foot pain/discomfort before and after wearing the insoles.

(1) After wearing the viscoelastic insoles for 8-12 weeks, 10 percent and 20 percent fewer band members reported foot pain when wearing insoles for <50 percent or ≥ 50 percent of the time, respectively (Figure 1). Therefore wearing insoles for even short periods of time may have some beneficial effects in the reduction of foot pain.

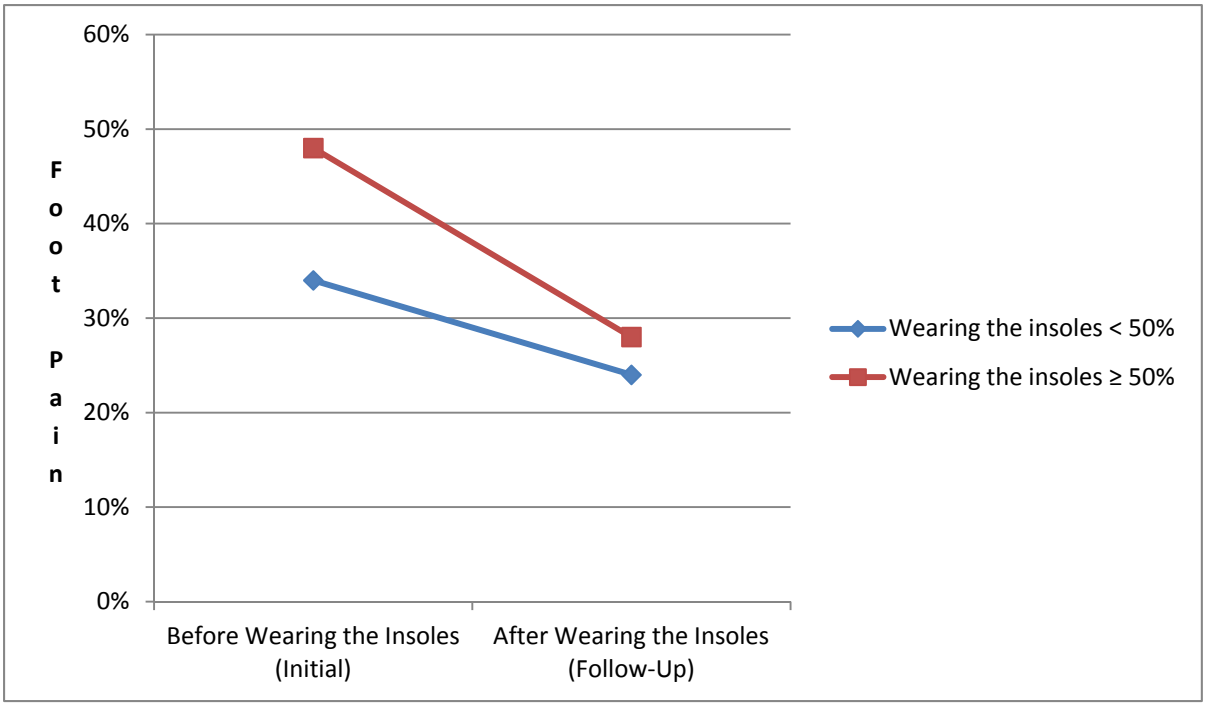

Figure 1. Percent of Band Members with Foot Pain Before and After Wearing the Insoles for those who the insoles < 50 percent and ≥ 50 percent of the Time.

(2) Other studies have also examined the effects of viscoelastic insoles on musculoskeletal pain and discomfort.[4, 12, 27, 28, 29] In previous investigations researchers found that viscoelastic insoles reduce back, leg and foot pain, and that subjects reported they were more likely to wear insoles after trying them. [4 12] In the current project 56 percent of band members also said they would be more likely to wear insoles to just wearing shoes alone.

b. Risk factors for foot pain.

(1) We identified several factors associated with foot pain including older age, BMI, shoe comfort, insoles worn prior to the project, and moderate marching time. Others studies have also shown that the prevalence of musculoskeletal pain increases with age.[30, 31, 32] In the current study, those reporting foot pain increased over 3-fold in

the 45-46 year olds compared to the 25-34 year olds. The association between age and foot pain may have to do with prior injuries which have been shown to be risk factors for new injuries in many studies.[33, 34, 35, 36, 37] Also ageing results in a loss of muscular endurance and aerobic capacity[38] that may cause more rapid fatigue and pain even when standing and performing marching activities.

(a) In a study of employed persons in Quebec, where approximately 60 percent of the workers usually stand throughout the day, investigators found that the risk of foot and ankle pain was 1.86 times higher for those aged 50-65 compared to 25-39 year olds.[39] Prolonged standing alone throughout the work day was also found to place the workers at a 3.7 times greater risk of foot and ankle pain when compared to those who sat throughout the day with the possibility of getting up at their will.[39]

(b) In the current project, foot pain increased over 2.6 times among those with a BMI of 30-36 kg/m^2 (obese) compared to those with a BMI of 20-25 kg/m^2 (normal). In the same Quebec study as above, being obese (≥ 30 kg/m^2) placed workers at a 2.23 times greater risk of foot and ankle pain when compared to those with a BMI of 20-26 kg/m^2. Others studies have also shown that being overweight can be a risk factor for foot pain[40] as well as specific types of foot pain such as plantar fasciitis[41] and chronic plantar heel pain.[42] The association between BMI and foot pain may be due to the higher vertical pressures under the heel and midfoot during standing and walking,[43] which could then result in higher internal stresses within the foot[44] causing damage to soft tissue structures and foot pain.

(2) After wearing the insoles there was a 20 percent reduction in the number of band members reporting shoes as not comfortable or somewhat comfortable. In a previous study of the U.S. Army Band poor cushioning of the shoe was associated with pain and discomfort of the feet.[3] The extra cushioning provided by the insoles may have contributed to the decrease in foot pain.

(3) Seventy five percent of band members who wore their own insoles previous to the project, initially reported foot pain, compared to 40 percent of band members not wearing insoles. It is likely those wearing insoles prior to study were doing so to relieve some of their pain. The majority of insoles worn prior to the project were purchased off the shelf. Unfortunately, we do not know the exact type of these previously worn insoles. Nonetheless, the viscoelastic insoles used in the present investigation were successful in reducing foot pain in a large proportion of band members, even among those who were previously wearing insoles of indeterminate types. In a study investigating the effectiveness of insoles on plantar pressure redistribution, investigators found that contoured insoles were better at increasing contact area and reducing peak local peak pressure when compared to a flat insole.[20] The insoles used in the present investigation were contoured. It may have been that the band member's previous

insoles were flat, did not provide adequate support, and/or lacked the cushioning needed to effectively reduce foot pain.

(4) For marching, 70 percent of band members who reported marching between 30-90 minutes reported foot pain compared to 25 percent and 38 percent of band members marching less than 30 minutes and ≥ 91 minutes, respectively. When comparing band members BMI and time spent marching, band members who marched for < 30 minutes had an average BMI of 25±2, band members who marched for 30-90 minutes had an average BMI of 27±4, and band members who marched for ≥ 91 minutes had an average BMI of 26±2. Higher BMI's have been shown to place individuals at a higher risk of foot pain.[39] This may account for the increased amount of foot pain in band members who reported marching between 30-90 minutes on average.

c. Foot pain before and after wearing the insoles for 8, 9-11, and 12 weeks.

(1) Wearing the insoles > 8 weeks resulted in fewer band members reporting foot pain. However, when examining variables within the 8, 9-11 and 12 week groups, it was found the Ceremonial group made up the majority of the 8 week group (Table 14). The Ceremonial group also performs the most standing and marching when compared to the other groups (Table 15).

Table 14. Percent of Time Band Members wore the insoles by Performance Group for Those who Wore the Insoles ≥ 50 Percent of the Time

Performance Group	Wore Insoles for 8 Weeks	Wore Insoles for 9-11 Weeks	Wore Insoles for 12 Weeks
Ceremonial	69%	29%	10%
Concert	23%	57%	40%
Chorus	8%	14%	50%

Table 15. Percent of Time Spent Standing and Marching by Performance Group for Band Members who Wore the Insoles ≥ 50 Percent of the Time

Performance Group	Standing for over 121+ minutes on average per day	Marching for over 121+ minutes on average per day
Ceremonial	67%	71%
Concert	27%	29%
Chorus	7%	0%

(2) Because the Ceremonial group made up the majority of the 8 week group and they perform the most standing and marching, their foot pain may be more severe and it may take longer than 8 weeks to notice a significant reduction in foot pain. In a 5 week study investigating police officers who walk an average of 3 miles per day, investigators

found a reduction of tiredness in the feet after wearing insoles for 5 weeks. However, they found no improvement in back or leg discomfort.[45] In another study investigating postal workers at a bulk mail center on employees who spend at least 50 percent or more of their day standing on thinly covered or plain concrete surfaces, researchers found a 67 percent reduction in perceived foot, knee and back pain. This study was conducted over a 3 month work period.[46] Possibly wearing insoles for a longer period of time for those performing prolonged hours of standing and walking could have an effect on the reduction of foot, knee and back pain.

d. Pain/discomfort of the feet and back.

(1) Overall, band members who wore the insoles ≥ 50 percent of the time were 74 percent less likely to have foot pain after wearing the insoles for 8-12 weeks. In previous investigations researchers found that 1) incorporating arch support into the insoles improved specific types of foot pain (such as hallux valgus, arch and heel pain)[47], 2) that insoles were associated with a reduction in stress fractures,[48] 3) that wearing insoles is more comfortable than not wearing insoles,[48] and 4) a decrease in foot pain.[4,12] In the current project, the reduction in foot pain may be associated with increased comfort, arch support and the extra cushioning provided by the insoles.

(2) Pain and discomfort of the foot has been associated with increased plantar pressure.[21] In previous studies[22, 20] insoles rated the most comfortable provided an even distribution of pressure at the plantar surface. Contoured insoles were better than flat insoles in their ability to reduce peak pressures.[20] It has been shown that clinically painful plantar areas tend to occur at pressures exceeding 260 kilonewton per meter squared (kN/m^2).[21] In a study investigating seven shoe insoles, investigators found a reduction in mean pressure at the metatarsal site from 398.15kN/m^2 in the no insole condition to a range (depending on the insole) of 286.35 to 186.33kN/m^2 while wearing the different types of insoles. They concluded that five of the seven insoles could be effective in reducing high plantar pressure pain and most likely increased comfort.[23] In the current study, the effect of contoured insoles, the increase in contact area of the foot with the insole, and a possible more evenly distributed plantar surface pressure could have decreased foot pain while increasing comfort levels of the foot.

(3) The added cushioning of insoles has been shown to provide additional shock absorption[15, 16, 17] as well as decreasing peak acceleration during impact.[18, 19] In previous investigations, researchers have found that viscoelastic insoles reduced the amplitude of shock waves by 42 percent when compared to a no insole condition[49] and that peak pressure generated at the forefoot and heel have been reduced by 24 percent and 37 percent, respectively when compared to a no insole condition. Therefore insoles will likely reduce foot pain because they distribute plantar pressures (contour insoles do this better)[20], reduce peak pressures on impact and absorb a greater percentage of

shock.[19] It has also been suggested that long term wear of insoles by healthy subjects will decrease the loading of the musculoskeletal system (through increased shock absorption) and may decrease the progressive weakening of the natural shock absorbers (ex: ankles, knees).[49]

(4) Band members who marched for 30 to 90 minutes had a 6.8 times greater risk of foot pain, than those who marched for < 30 minutes. Band members who marched for > 91 minutes were also less likely to experience foot pain. As stated earlier band members who marched for 30-90 minutes had a BMI of 27±4, compared to a BMI of 25±2 for band members marching < 30 minutes and a BMI of 26±2 for those marching > 91 minutes. As also stated earlier higher BMI's have been shown to place individuals at a higher risk of foot pain.[39]

(5) Band members who wore the insoles ≥ 50 percent of the time were 59 percent less likely to have back pain after wearing the insoles for 8-12 weeks. Other studies have also shown a positive relationship between the use of shoe inserts and a reduction in back pain.[4, 10, 11, 46, 28] In a previous study investigators found that 79 percent of subjects who wore insoles for one year reported excellent or good improvement in back pain compared to a control group where only 45 percent reported excellent or good improvements in back pain.[28] The researchers suggest that poor walking impact attenuation was a cause of prolonged strain on the intervertebral structure and that viscoelastic insoles may reduce back pain through increased impact attenuation. Therefore the reduction in impact attenuation, peak impact pressures on the musculoskeletal system, and fatigue could attribute to the reduction in back pain.

e. Limitations.

(1) Not all band members wore the insoles 100 percent of the time. Therefore we had to analyze the data for those who wore the insoles ≥50 percent of the time.

(2) Band members all wore various brands of dress shoes. Some rated their shoes as comfortable, others as uncomfortable. However this was not found to have an effect on musculoskeletal pain.

(3) Report was based on questionnaire responses and not objective measure.

8. RECOMMENDATIONS. Band members wearing insoles were less likely to experience musculoskeletal pain/discomfort. It is recommended that band members

use insoles during practices, rehearsals, and performances to decrease the risk of musculoskeletal pain/discomfort.

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APPENDIX A

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APPENDIX B

Army Band Insole Baseline Questionnaire (Example)

In this questionnaire you will be asked about band activities, your health, and your lifestyle. Please answer each question as accurately as possible.

1. Name (Please Print)_____

2. Gender ☐ Male
☐ Female

3. Height _____ Weight _____

4. Which unit are you in?
☐ Blues
☐ Ceremonial
☐ Chorale
☐ Chorus
☐ Concert
☐ Strings
☐ Support
☐ Other _____

5. Are you a vocalist?
☐ No
☐ Yes

6. If you play an instrument during band activities, what instrument do you play? List your primary instrument

_____ ☐ N/A

7. How much does your primary instrument weigh? _____ ☐N/A

8. REHEARSAL, PRACTICE AND PERFORMANCE DURATION. When you rehearsed, practiced, and/or performed, how long did you play your instrument(s) or sing and/or dance, on **average per day** (including U.S. Army Band activities and elsewhere)?

a. In the last 3 weeks: _____ Minutes or _____ Hours

b. In the last 6 months: _____ Minutes or _____ Hours

9. STANDING. When you rehearsed, practiced, and/or performed, how long did you spend standing, on **average per day**?

a. In the last 3 weeks: _____ Minutes or _____ Hours

b. In the last 6 months: _____ Minutes or _____ Hours

10. MARCHING. When you rehearsed, practiced, and/or performed, how long did you spend marching, on **average per day**?

a. In the last 3 weeks: _____ Minutes or _____ Hours

b. In the last 6 months: _____ Minutes or _____ Hours

11. SHOES. What is the current brand and model of the shoes you wear most of the time for rehearsals, practices, and performances?

Brand_____ Model_____

a. Are these shoes comfortable?

- ☐ Not comfortable
- ☐ Somewhat comfortable
- ☐ Comfortable
- ☐ Very comfortable
- ☐ Extremely comfortable

12. THE FOLLOWING QUESTIONS ASK ABOUT INSOLES AND ORTHOTICS. Insoles are designed to provide a cushioning effect and shock absorption. Orthotics are functional devices designed to correct and optimize foot function.

a. INSOLES. Do you currently wear insoles? ☐ No (go to Question 13b)
☐ Yes

(1) If yes, are these insoles:

- ☐ Custom made
- ☐ Bought off the shelf (please specify Brand)_____

(2) How long have you been wearing insoles? _____years or _____months

b. ORTHOTICS. Do you currently wear orthotics? ☐ No (go to question 14)
☐ Yes

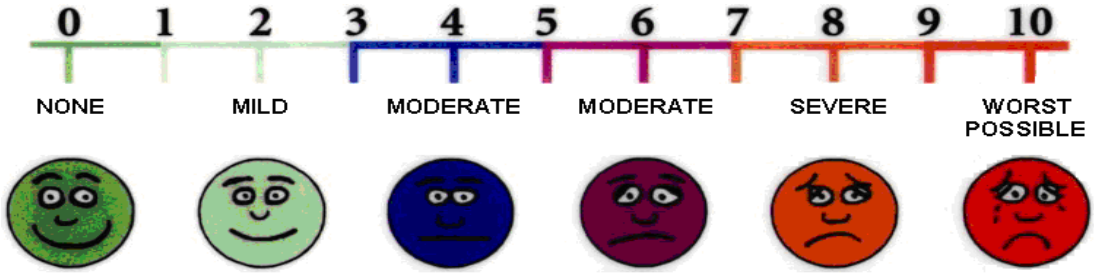
If yes, how long have you been wearing orthotics? _____years or _____months

13. FOOT PROBLEMS: Do you have foot pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activities**? ☐ No (go to question 15)
☐ Yes

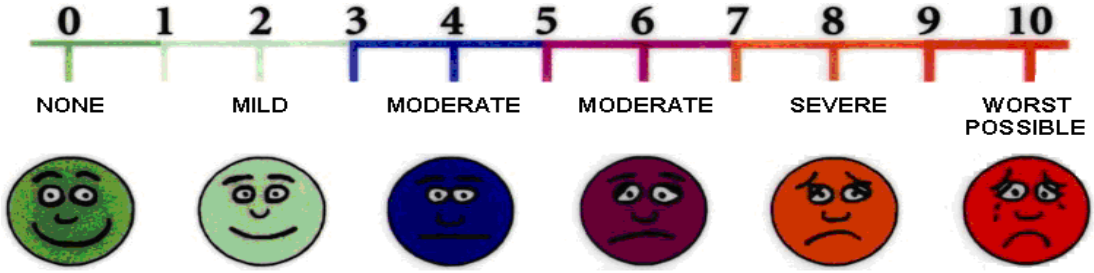
a. Is this caused by your participation in Band activities? ☐ No ☐ Yes

b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of your feet (circle a number).

In the last 3 weeks:



In the last 6 months:

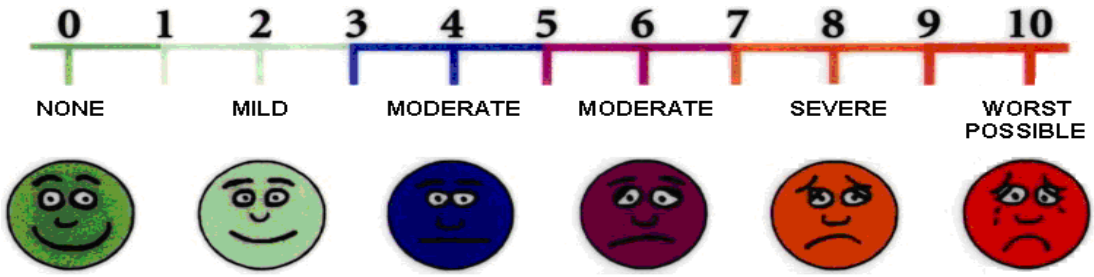


14. KNEE PROBLEMS: Do you have knee pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activities**? ☐ No (go to question 16)
☐ Yes

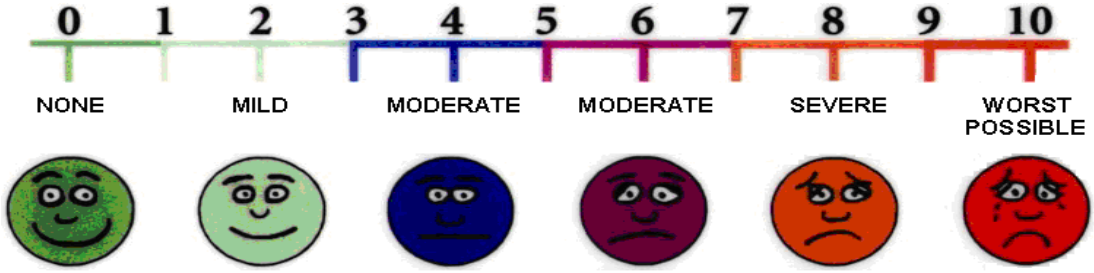
a. Is this caused by your participation in Band activities? ☐ No ☐ Yes

b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of your knees (circle a number).

In the last 3 weeks:



In the last 6 months:

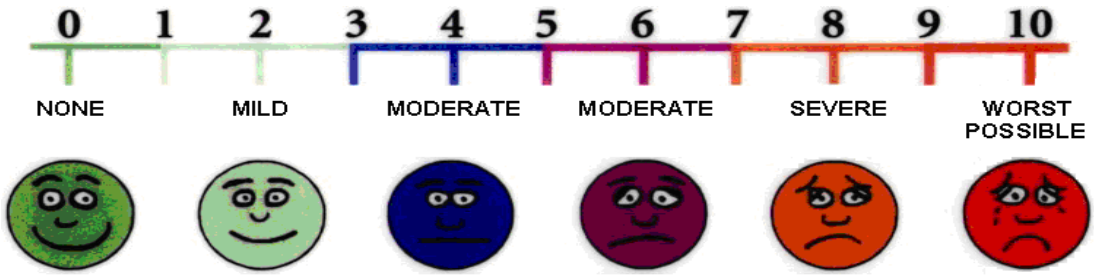


15. BACK PROBLEMS: Do you have back pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activities**? ☐ No (go to question 17) ☐ Yes

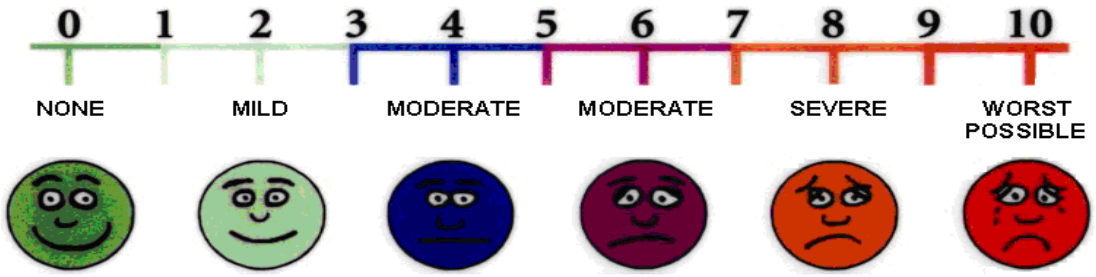
a. Is this caused by your participation in Band activities? ☐ No ☐ Yes

b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of your back (circle a number).

In the last 3 weeks:



In the last 6 months:



16. AEROBIC EXERCISE. Over the time periods listed below, how many days per week did you perform aerobic exercise (running, cycling, swimming, etc.), on average?

	None	1 day	2 days	3 days	4 days	5 days	6 days	7 days
In the last 3 weeks	☐	☐	☐	☐	☐	☐	☐	☐
In the last 6 months	☐	☐	☐	☐	☐	☐	☐	☐

17. STRENGTH TRAINING. Over the time periods listed below, how many days per week did you exercise to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.), on average?

	None	1 day	2 days	3 days	4 days	5 days	6 days	7 days
In the last 3 weeks	☐	☐	☐	☐	☐	☐	☐	☐
In the last 6 months	☐	☐	☐	☐	☐	☐	☐	☐

APPENDIX C

Army Band Insole Questionnaire (Follow-Up) (Example)

In this questionnaire you will be asked about band activities, your health and lifestyle. Please answer each question as accurately as possible.

1. Name (Please Print)_____

2. Which unit are you in?
   - ☐ Blues
   - ☐ Ceremonial
   - ☐ Chorale
   - ☐ Chorus
   - ☐ Concert
   - ☐ Strings
   - ☐ Support
   - ☐ Other _____

3. REHEARSAL, PRACTICE AND PERFORMANCE DURATION. In the last 8 weeks, when you rehearsed, practiced, and/or performed, how long did you play your instrument(s) or sing and/or dance, on **average per day** (including US Army Band activities and elsewhere)?

_____Minutes or _____ Hours

4. STANDING. In the last 8 weeks, when you rehearsed, practiced, and/or performed, how long did you spend standing, on **average per day**?

_____Minutes or _____ Hours

5. MARCHING. In the last 8 weeks, when you rehearsed, practiced, and/or performed, how long did you spend marching, on **average per day**?

_____Minutes or _____ Hours

6. SHOES. What is the current brand and model of the shoes you have worn for rehearsals, practices and performances during the last 8 weeks?

Brand_____ Model_____

a. Are these shoes comfortable?

- ☐ Not comfortable
- ☐ Somewhat comfortable
- ☐ Comfortable
- ☐ Very comfortable
- ☐ Extremely comfortable

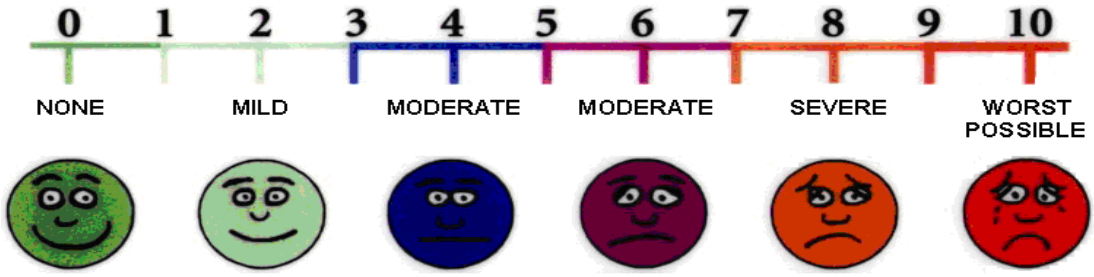
7. FOOT PROBLEMS: In the last 8 weeks, did you have foot pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activity**?

- ☐ No (go to Question 9)
- ☐ Yes

a. Is this caused by your participation in Band activities?

- ☐ No
- ☐ Yes

b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of the foot within the last 8 weeks (circle a number).



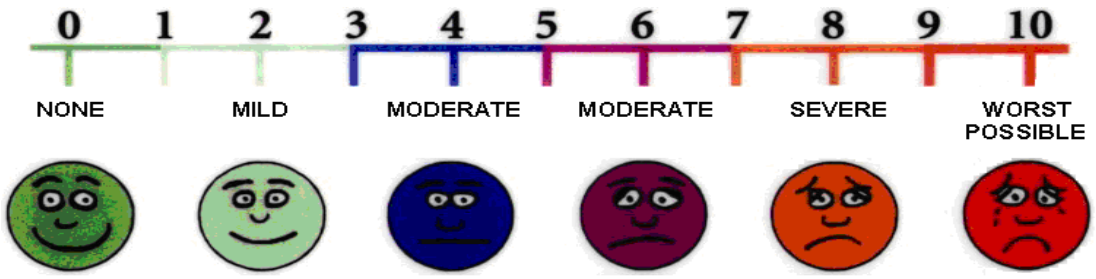
8. KNEE PROBLEMS: In the last 8 weeks, did you have knee pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activity**?

- ☐ No (go to Question 10)
- ☐ Yes

a. Is this caused by your participation in Band activities?

- ☐ No
- ☐ Yes

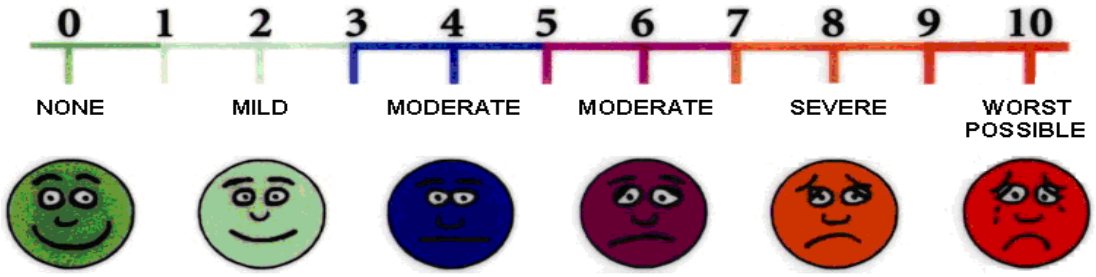
b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of the knee within the last 8 weeks (circle a number).



9. BACK PROBLEMS: In the last 8 weeks, did you have back pain, soreness, discomfort, weakness, numbness, or tingling that causes you to limit your **daily activity**? ☐ No (go to Question 11) ☐ Yes.

a. Is this caused by your participation in Band activities? ☐ No ☐ Yes

b. Grade the pain, soreness, discomfort, weakness, numbness, or tingling of the back within the last 8 weeks (circle a number).



10. AEROBIC EXERCISE. How many days per week did you perform aerobic exercise (running, cycling, swimming, etc.) in the last 8 weeks on average?

None	1 day	2 days	3 days	4 days	5 days	6 days	7 days
☐	☐	☐	☐	☐	☐	☐	☐

11. STRENGTH TRAINING. How many days per week did you exercise to improve your strength (free weights, universal, nautilus, push-ups, sit-ups, etc.) in the last 8 weeks on average?

None	1 day	2 days	3 days	4 days	5 days	6 days	7 days
☐	☐	☐	☐	☐	☐	☐	☐

12. INSOLES: We provided you with a set of insoles 8 weeks ago. What percentage of time did you wear these insoles during the last 8 weeks:

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Practices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rehearsals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Performances	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

a. Did the insoles given to you 8 weeks ago, provide a higher level of comfort when **standing** during band activities compared to wearing your band shoes without the insoles?

☐ No ☐ Yes ☐ No difference

b. Did the insoles given to you 8 weeks ago, provide a higher level of comfort when **marching** during band activities compared to wearing your band shoes without the insoles?

☐ No ☐ Yes ☐ No difference

c. How does wearing insoles in your band shoes during the last 8 weeks, compare to wearing your band shoes without the insoles for **comfort**?

☐ were less comfortable ☐ were no different ☐ were more comfortable

Example: For comfort, the insoles _____ than wearing my band shoes without the insoles.

d. How does wearing insoles in your band shoes during the last 8 weeks, compare to wearing your band shoes without the insoles for **cushioning**?

☐ had less cushioning ☐ were no different ☐ had more cushioning

Example: For cushioning, the insoles _____ than wearing my band shoes without the insoles.

e. How does wearing insoles in your band shoes during the last 8 weeks, compare to wearing your band shoes without the insoles for **support**?

☐ were less supportive ☐ were no different ☐ were more supportive

Example: For support, the insoles _____ than wearing my band shoes without the insoles.

f. After wearing the insoles for the last 8 weeks, which do you prefer?:

☐ Shoes alone (without insoles) ☐ No preference ☐ Shoes with insoles

13. Other comments on the insoles?